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INDIVIDUAL DIFFERENCES IN TRAINING PERFORMANCE:

THE DERIVATION OF A PREDICTION MODEL

BY

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B.A., University of Central Florida, 1984

THESIS

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ABSTRACT

This research examines the use of non-cognitive personality measures as supplements to traditional cognitive ability measures for predicting training performance. The Hogan Personality Inventory (HPI) significantly predicted an overall performance measure ($R^2 = .17$) for Navy BE&E Students ($N = 155$). However, when applied as a supplemental predictor composite to the military cognitive measure (ASVAB), the resulting increase in R^2 (.04) failed to attain significance, $F(6, 144) = 2.17$, $p > .05$). In further analyses, several HPI and ASVAB scales combined to significantly predict selected performance criteria. The ASVAB remained as the primary source of information. It is quite possible that, for traditional academic training, cognitive ability measures provide the most valuable insight in terms of individual potential. Personality may have a more profound effect in cases of unconventional skill training or training for occupations of risk.

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INTRODUCTION

Personnel training has become a multi-billion dollar operation in both the military and private sectors. The proper identification and selection of individuals for training placement is a critical prerequisite for effective training. Selection decisions are traditionally based on objective ability tests measuring intelligence and general aptitude. However, these neglect other non-cognitive, motivational aspects of individual differences which also influence performance. With the exception of learning style and skill acquisition studies, these individual characteristics have received limited scientific investigation. Glaser (1982), Wheaton, Rose, Fingerman, Korotkin, and Holding (1976), and Riding (1983) have all noted the exclusion of individual difference variables in educational and training research. Individual difference variables may include, but are not limited to, abilities, aptitudes, personality, interest, and biographical histories. These personal characteristics govern the unique performance of individuals in all situations.

Background

Measures of individual differences first emerged as mental test in the late nineteenth century with the pioneering works of Galton, Cattell, and Binet (Anastasi, 1982). Galton launched the testing movement with his interest in measuring characteristics of related and unrelated persons. Both Galton and Cattell used sensory discrimination tests to gauge intellect, though Cattell added reaction time to his test battery.

Cattell was interested in determining the intellect level of college students and was the first to use the term "mental test" in the psychological literature. Binet later changed the testing method by focusing on measures of judgement, comprehension, and reasoning. The early Binet tests were used to determine childrens' mental levels and later evolved into the commonly used "IQ" tests.

World Wars I and II provided the main stimulus for personnel testing as the urgent need arose to select and classify individuals on a mass scale. One of the first applications of the field of psychology to the military is described by Yerkes (1918) in his 1917 presidential address to the American Psychological Association. To assist in the war effort, APA proposed several areas in which they could support the military. These areas included recruit classification by general intellectual level as well as psychological examination "to eliminate the mentally unfit" (p. 94). Concurrently, Woodworth was developing the Personal Data Sheet, the prototype of the personality questionnaire, to identify seriously neurotic men who would be unfit for military service. While the Personal Data Sheet was never implemented for this purpose, it served as the model for most subsequent emotional adjustment inventories.

The Army Alpha and Beta tests of WWI were a direct result of the APA committees' recommendations. These "IQ" tests were administered to obtain some objective basis for assigning recruits, and to provide military commanders with some measure of the ability of their men. Objective testing later enabled Army screening to eliminate "bad risks"

or individuals who could not withstand the severe demands of war and to select those who were quickly and most readily trainable.

Individual Factors In Training

Subsequently, these traditional aptitude tests have persisted as selection and placement instruments for military recruits. Organizations in the private sector have rarely employed this method for training placement. Training selection decisions in this environment are often based on recognition of individual differences. However, this recognition is in the form of observed job performance deficiencies and is usually very general as well as subjective. Even when objective individual difference measures are employed, they are generally restricted to ability measures. In some instances, individual assessment is not even part of the placement process. That is, training is given at the group level where entire occupational classifications receive simultaneous, identical training. All employees are trained regardless of individual deficiencies, proficiencies, needs, abilities, interests, motivation, etc. The simple assumption of such personal characteristics significantly reduces the accuracy of training selection and placement decisions.

Training is an individual concern. In some cases, a training program can be designed for the average trainee that is expected to attend. However, the key to efficient training then becomes the selection of that particular group or population of trainees, and the development of training for that group. The individual's unique attributes should correspond to the content type and level of in-

struction in a program. Dunnette (1966) supports this contention as follows:

At one extreme, if all persons were perfectly modifiable through training, individualized programs of job placement would be quite unnecessary At the other extreme, if persons were unchangeable through training or experience, programs of personnel selection would be the only way of assuring a good fit between men and jobs It becomes necessary to base selection and placement partly on information of what training can achieve and to select persons who will be able and willing to profit from training. (p. 8)

This fit between individuals and training programs can be determined by examining the degree to which certain personal characteristics correspond to successful performance in training. The identified variables may then be used to aid future training selection decisions. This allows a better utilization of human resources. Individuals may be placed in the training situations and operational positions where they will be most productive.

Proper selection for training placement is necessary for financial as well as the aforementioned practical reasons. Millions of dollars are spent each year on the implementation of new "revolutionary" training techniques in both military and private organizations. Yet, the largest cost of training remains the labor cost of the individual trainee (Wexley and Latham, 1981). Potential costs associated with inaccurate personnel decisions and predictions are tremendous. For example, in instances where the attrition rate in training program

exceeds 50%, the organization experiences significant financial loss (for one such example, see Hogan and Hogan, 1985). These losses multiply when training placements are conducted on mass scales with a continual influx of potential trainees and with continual training positions to fill. That is, in mass scale, placements are often made more quickly and with less consideration to prediction errors (Dunnette, 1966). Such circumstances are particularly relevant to training in the armed services. Inaccurate predictions conducted on such a large scale have significant impact on government spending. Thus, proper selection and placement for military occupations is a high priority issue. The Department of Defense expressed this concern in a recent report to Congress (1981):

Proper enlistment screening and job placement are prerequisites for efficiencies in training, retention of skilled personnel, and mission performance. Any deficiencies in the selection and classification system lead to increased training times and cost, dissatisfied personnel with concomitant decreases in morale, productivity, and retention, and critical shortages of skills caused by failure to achieve optimal assignment of available manpower into the various occupation.

(p. 5)

Training in the Navy alone is an enormous operation. Over 100,000 recruits enter the recruit training centers per year at an annual cost of 3.5 billion dollars (fiscal 1983) (Nauta, Ward, and D'Ambrosia, 1983). The selection and placement process becomes further complicated given the pool of applicants for military enlistment. Most are recent

high school graduates or, in fewer cases, dropouts who have never held permanent full time jobs (Eitelberg, Laurence, Waters, and Perelman, 1984). Information on past job performance, proficiencies, or deficiencies is simply not available. Thus, military placement specialists must obtain and rely on indicators of potential performance.

Prediction of Training Performance

The early identification and prediction of individuals who will profit most from specific types of training, perform best in training, complete training most quickly, or be permitted to skip portions of training has important implications for all sectors involved in personnel assessment (Gordon and Cohen, 1973; Gordon and Kleiman, 1976). Indicators or "predictors" of performance are based on the unique individual characteristics. Researchers have expressed increased interest in the influence of these individual difference variables in training environments (Argyris, 1976; Cronbach, 1967; Dunnette, 1966; Ghiselli, 1973; Glaser, 1982; Goldstein, 1974, 1980; Guion, 1965; Hinrichs, 1976; Riding, 1983; Terborg, 1981; Wexley, 1984). For some, this represents a necessary conceptual merging between two separate camps which have rarely recognized the existence of one another. Learning and training researchers have virtually ignored individual differences while examining the effects of their treatments (Glaser, 1982; Goldstein, 1974). In the few applications where these differences have not been considered mere annoyances, the major emphasis has been on identifying general "intelligence" (Riding, 1983). This is most sur-

prising given the consensus that individual variation can be attributed to one's unique patterns of aptitudes, interests, attitudes, and personality (Dunnette, 1966). Collectively, these variables are thought to determine a person's ability and motivation to perform in a given situation (Cronbach, 1967; Riding, 1983; Wexley, 1984).

The ability/aptitude domain is recognized by most as an important determinant of training performance. However, the opinions are mixed as to which specific variables will best supplement ability measures. Riding (1983) suggested starting with the introversion-extroversion dimension to represent motivational tendencies. Cronbach (1967) pointed to documented interactions involving willingness to risk failure, confidence, and motivation, with self directed achievement. He believed that personality and styles of thought may be as or more important than ability in determining performance. Regardless of the differences in focus, the general consensus is that individual variation is multi-dimensional. Training performance may be a function of a variety of interacting personal and situational characteristics.

Unquestionably, the task at hand is to delimit the dimensions of individual differences for study in training environments. For this purpose, it may be useful to discriminate between two separate questions in examining individual differences in performance. First, "can" a particular individual benefit from training? "Can" indicates whether the person possesses the ability necessary for knowledge or skill acquisition. Second, "will" that individual benefit from training? "Will" indicates whether the trainee has the drive, desire, interest, or motivation to use that ability. Ability tests measure the cognitive

"can do" aspect of individual behavior. Personality tests measure the non-cognitive "will do" behavioral domain. While other tests may be applicable for these purposes, personality (non-cognitive) and ability (cognitive) tests represent the most comprehensive measures for both dimensions.

Cognitive Predictors

Ability and aptitude tests represent measures of cognitive faculties or intelligence. They are considered the traditional instruments of personnel assessment for selection and classification. These measures do not simply imply past, present, or future competence, but all of these together. In other words, one's current talent or capacity, and one's potential to perform depend both on natural enduring capabilities as well as past acquired proficiencies. In predicting if an individual "can" benefit from training, the concern is whether that person possesses the ability necessary for the particular knowledge or skill acquisition. Clearly, this information has impact on what training can achieve for a given individual.

A review of all previous research (Ghiselli, 1973) yielded low to moderate validities for the prediction of training performance with general ability tests. Results showed highest demonstrated validities for clerical (.42-.52), protective (.42), and service (.42) occupations while less substantial and consistent validities were found for managerial (.27-.33), industrial (.24-.49), and trade/craft (.26-.49) occupations. Similar patterns emerged with tests of spatial and mechanical abilities though coefficients overall were slightly lower.

Validities diminished further with tests of perceptual accuracy and motor abilities to an approximate average of .25.

Two additional applications provide much less support for the use of ability tests as performance predictors. Gordon and Kleiman (1976) failed to attain significant validities for predicting course grades with mental ability tests in two of three police academy samples. However, it is important to note the small sample sizes ($n = 29$, $n = 27$) of these two groups as well as the moderate to high validity obtained in the third sample (.56, $p < .01$, $n = 45$). Intelligence tests have also been rather unsuccessful in selecting individuals for foreign language training even when cutoff scores have been employed to eliminate those of limited intellectual abilities (Carroll, 1965).

The number of empirical studies investigating the prediction of performance in training via ability tests is limited. The military services are primarily responsible for this line of research. In these studies, the most frequently employed prediction instrument is the Armed Services Vocational Aptitude Battery (ASVAB).

The ASVAB is currently used military-wide to place recruits in various training programs. One composite of the ASVAB, the Armed Forces Qualification Test (AFQT), is used to screen potential recruits and to establish a measure of quality of the new recruits. The Navy supplements this measure with age and educational information to better estimate the probability that the applicant will successfully complete the first year of service. The use of a single test battery for both screening enlistees and assigning them to military occupations evolved from the need to make the testing process much more expedient

(Eitelberg, et al., 1984). Such a process was expected to allow improvement in the matching of applicants to available job positions for those qualified.

The ASVAB consists of several subtests designed to measure general ability in the following areas: arithmetic reasoning, numerical operations, paragraph comprehension, word knowledge, coding speed, general science, mathematics knowledge, electronics information, mechanical comprehension, and automotive-shop information. Various combinations of the ASVAB subtests make up aptitude composites which are used to classify recruits and to determine eligibility for occupations and training assignments. In theory, the intent is to maximize the fit between individual potential and occupational positions. The following studies examine the extent to which the ASVAB accurately predicts optimal recruit placement.

Booth-Kewley, Foley and Swanson (1984) undertook an extensive study to examine the ASVAB's predictive validity. The study encompassed all ASVAB selector composites for predicting performance in Navy schools. For the 47 "A" schools involved, using a final school grade (FSG) criterion, the median uncorrected and corrected validity coefficients were .35 and .55, respectively. The time to completion criterion revealed median corrected and uncorrected validities of -.27 and -.42, respectively, while the corresponding values for the prerequisite BE&E schools were -.36 and -.57. Of over 100 schools studied, several were identified for which an alternative ASVAB composite might increase performance prediction, though lack of extensive data and Navy inexperience with alternative composites failed to justify change.

Nevertheless, change did appear warranted in two "A" schools and three BE&E schools. Interestingly, the authors noted that the validities against the time criterion were lower than desired and expected by most schools.

Reviews by Yarkin-Levine, Weldon, and Fleishman (1983) and Black and Campbell (1983) both illustrated the inadequacy of cognitive tests in predicting performance criteria. Yarkin-Levine et al. found that the ASVAB failed to measure 27 of 28 ability dimensions necessary for skill acquisition in electronic troubleshooting training. In a cumulative summarization of predictors of tank crew-man performance, Black and Campbell concluded that psychomotor/perceptual motor tests were sometimes predictive of trainee performance as were perceptual paper and pencil tests, though the latter accounted for only 2.5% of the variance in gunnery scores. Yarkin-Levine et al. concluded that with respect to statistical considerations of reliability and validity, the overall quality of the ASVAB is only moderate. Criticism was also sounded by Christal (1981) who stated that ability testing research in the military has stagnated. He noted that the military persistently used the same tests and attained similar validities as those of twenty years previous. Furthermore, Christal believed that present ability tests may be failing to measure the abilities important for forecasting performance.

While these studies and opinions may not be inclusive, they at least indicate probable deficiencies in the ASVAB's ability to predict training performance with exceptional accuracy. One could safely conclude that the test battery has low to moderate success in predicting

the abilities it is designed to measure, yet, the realization remains that aptitude measures may not tell the whole story.

Non-Cognitive Predictors

Personality constitutes all non-cognitive variations in thought and behavior that differentiate one person from another, and encompasses such concepts as attitudes and motivation (Gough, 1976). The applicability to training environments seems apparent: given an individual with a diagnosed high "ability," what influences whether or not that individual will use that ability? One factor that influences one's effort is the unique non-cognitive aspects of individual differences. Personality assessment represents one method for understanding these personal characteristics.

Traditionally, personality assessment has not been accepted as a procedure for predicting training performance. However, the limited research which has appeared has demonstrated positive and significant results. In 1973, Ghiselli summarized all previous research on training performance predictors. Personality appeared in only a few studies involving managerial training. The average validity (.53) indicated that personality measures were successful predictors of training performance.

The one, and possibly only, persistent application of personality tests to prediction/selection is in law enforcement officer screening. Inwald and Shusman (1984) conducted a recent study to test the prediction power of the Inwald Personality Inventory (IPI) against that of the Minnesota Multiphasic Personality Inventory (MMPI) in this

context. "Results indicated that scales measuring 'acting out' behaviors (as measured on the IPI scales 'trouble with the law,' 'job difficulties,' and 'drugs') best predicted negative behaviors for male police officers on eight job performance measures [(behavior in academy training)] [($p < .05$)]" (p. 10). The IPI was determined to measure a much wider range of antisocial behaviors than can be assessed through departmental investigations or biographical data.

Personality as a training predictor has received less attention than ability or aptitude tests. Again the majority of studies have been conducted within the military services.

Both the Army and Air Force have released recent studies on the addition of personality to the current predictor batteries. Hough, Barge, Houston, McGue, and Kamp (1985) developed personality construct scales specifically for predicting Army school performance. On initial analysis, these measures proved to contribute unique variance to the existing prediction instrument. A current Air Force study is seeking to increase efficiency in the selection and classification of pilot trainees with a battery of supplemental predictors. Measures under investigation include personality as well as psychomotor tests and biographical histories (Kantor and Bordelon, 1985). The intent of this work is to obtain the most comprehensive view of individual potential possible.

Ryman and Biersner (1975) found significant relationships between success in three Navy diving schools and scales measuring leadership, training concern and training confidence. Those who passed diver training had significantly higher training confidence scores than those

who voluntarily dropped. The leadership scale and low scores on the training concern scale were correlated with training success. Attitudes toward training appeared to be potent predictors of success or failure as did motivated factors.

Despite over close to a century of research, personality assessment has made relatively little contribution to the area of training. The aforementioned results suggest that personality has much to offer as a selection/prediction instrument. Yet, personality is rarely used in this context as many believe that ". . . personality measures do not presently provide a good means for predicting . . . performance" (Kahan, Webb, Shavelson and Stolzenberg, 1985) (p. 28). Several factors are responsible for this apparent disregard of personality by training researchers.

The primary reason is related to the conceptual foundation of personality and its early uses. Historically, personality theory and research emphasized psychopathological and neuropsychic conceptualizations of personality structure. Selection studies sought to detect and exclude maladjusted individuals. For example, in the 1940s, L.L. Thurstone developed a managerial selection battery for Sears to detect latent psychopathological maladjustment in potential employees (Hogan, Carpenter, Briggs, and Hansson, 1985). Conceptually, personality is a product of psychiatry and clinical psychology and is thought to reflect some underlying set of neurotic structures governing behavior. This view is still evident in current uses of personality assessment. Inwald and Shushman (1984) applied these measures to predict negative job behavior by law enforcement officers and to

identify unstable or persons of "risk." Similar procedures have also been employed in the selection (or exclusion) of astronaut candidates (Collins, 1985). Psychological tests, behavioral observations, and physiological measures have been used to detect undersirable characteristics of potential crew members. The emphasis of these procedures is on excluding individuals on the basis of psychopathology; there is relatively little effort to identify individuals with the potential for exceptional performance. This psychopathological screening has been successful--there have been no known cases of acute psychotic breakdown in our space program. However, it tells us very little about how to "screen in" or select exceptional task performers drawn from a normal population. Consequently, personality assessment, especially as it relates to personnel selection, carries a negative connotation. A large number of people equate personality with psychopathology and are reluctant to accept these measures as predictors of normal performance.

The second reason for the exclusion of personality in training research is methodological in nature. Until recently, personality psychologists failed to reach any consensus regarding how to define personality and accordingly, how it should be measured. Every theory of personality provided its own set of variables or constructs and its own measurement procedures. Over 500 different measures of personality appeared in the research before 1957 alone (Mann, 1958). Consequently, the literature is filled with a maze of inconsistent findings. Mann referred to the field of personality assessment as being "test rich and integration poor" (p. 242), including measures as divergent as oral

sadism and adventurous cyclothymia. Researchers in other areas such as training have found little direction from the confusing state of the personality literature.

Subsequently, attempts have been made to rectify this situation. One possible reason for the confusion may have been that the number of personality variables is just too vast to coherently organize and study. However, a more plausible explanation is that different researchers were simply assigning different descriptors to the same trait dimensions. Factor analytic research supports this contention. Beginning with Tupes and Christal (1961) and Norman (1963), these studies have identified three to six broad dimensions which constitute "personality." The multitude of personality descriptors identified in previous literature can be expressed in terms of these few dimensions. This finding establishes a common vocabulary for both describing and measuring personality. The result is that this allows the systematic evaluation of personality variables in various applications. In summary, personality assessment has been excluded from training research on the basis of both conceptual and methodological shortcomings inherent in early personality theory.

Recent personality theorists have responded to these findings in an attempt to make personality assessment applicable to modern needs and concerns. One such response was the development of the Hogan Personality Inventory (HPI). Breaking from the traditional intra-psychic view, the HPI is based on a socioanalytic theory of personality. The socioanalytic theory reflects a more external conception of personality designed to account for individual differences

in status, popularity, and general performance rather than psychopathological maladjustment. This theory views personality from an observers perspective. As defined by Hogan (1983), "here the word 'personality' refers to a person's distinctive interpersonal style, to the kind of impression that person makes on others" (p. 59). This view is purely external; it refers to a person's social reputation, to his or her unique social stimulus value. Thus, trait terms do not describe some set of neurotic structures, but reflect observers' expressed evaluations of actors both as individuals and as potential group or societal contributors.

There are six broad dimensions in terms of which every reputation can be analyzed and described. These dimensions are based on the findings of the previously discussed factor analytic research. As identified by the HPI, these six dimensions included intellectance, adjustment, prudence, ambition, sociability, and likability. It is possible to both describe and forecast important aspects of individual behavior in terms of these six scales.

Intial HPI applications have been promising. The Hogan Personality Inventory (HPI) significantly predicted non-technical (patient care) job performance in a sample of 150 nursing aids in a large metropolitan hospital (Hogan, Hogan, and Busch, 1984). Fourteen sub-composites from these scales combined to yield a multiple regression coefficient of .61. In a Navy study, several sub-composites of the Hogan Personality Inventory (HPI) significantly predicted Navy personnel performance at an isolated Antarctic research station (Biersner and Hogan, 1984). By combining the sub-composites in a single scale, the correlation with the

positive criterion (peer nomination) was .52 ($p < .004$), and $-.46$ with the negative criterion. The HPI also proved useful in a study directed toward increasing training selection accuracy and reducing the attrition rates. Hogan and Hogan (1985) obtained a validity coefficient of .38 for predicting successful completion of Army and Navy explosive ordnance disposal technical training. Attributes seen as influential were those related to academic motivation, self concept, self sufficiency, and self confidence. Interestingly, the military ASVAB failed to predict training performance and was virtually of no use.

Multiple Prediction For Comprehensive Individual Assessment

These results suggest that this is a promising area for further investigation. This additional domain has to be measured and considered jointly with ability factors to obtain a more comprehensive view of individual potential. Again, knowledge of an individual's abilities and aptitudes does not indicate whether that person has the initiative to utilize that ability. Current research is already underway to refine the recruit screening process in all military services with the application of additional predictors (Eitelberg et al., 1984).

Regardless of the individual criticism, the apparent consensus is that conventional ability and aptitude tests fail to meet the requirements for sole inclusion for selection and prediction purposes. As early as 1933, Stagner identified the possibility that one reason for the unsatisfactory relationship between aptitude and achievement was ". . . the energy output of the individual which probably varies independent of ability" (p. 648). These tests should not be eliminated,

rather, they should be supplemented with additional assessment instruments. As Wexley (1984) concluded, substantial predictability is unlikely to be achieved unless all factors are considered together.

The objective of this study is to empirically re-examine the cognitive/non-cognitive issue in the prediction of training performance. Specifically, the goal is to study the use of the HPI as a supplemental predictor to the military ASVAB. The HPI is expected to account for the "will do" or motivational factors that contribute to performance. Furthermore, the inclusion of the HPI in the prediction battery is hypothesized to significantly increase training performance prediction over that obtained with the ASVAB alone.

METHOD

Subjects

Research subjects were 155 Naval trainees who arrived at the Naval Training Center, Orlando, Florida, in January and February, 1986 for entry into the Basic Electricity and Electronics (BE&E) school. This sample consisted of 120 male and 35 female students. The subjects' average age was 21 years, with educational levels ranging from non-completion of high school to four years of college. Military rank ranged from E1 to E4 with the majority holding a rank of E2. Subjects were training for occupations of Electronic Technician, Electricians Mate, and Fire Controllman.

Predictors

ASVAB

Selected scores from the Armed Services Vocational Aptitude Battery (ASVAB) served as measures of cognitive ability. These included measures on the four subtests which form the Electronics selection composite. This composite screens recruits for occupations requiring knowledge and/or use of electronic principles. Specifically, these four subtests are as follows:

1. Arithmetic reasoning (AR) - involves reasoning problems with arithmetic processes or solving arithmetic "word problems."

2. Mathematics Knowledge (MK) - involves solving mathematical problems which require knowledge of geometry, algebra, fractions, decimals, and exponents.
3. General Science (GS) - involves questions covering physical and biological science, geography, arts, sports, first aid, and military history.
4. Electronics Information (EI) - involves questions covering electrical and electronic components, symbols, diagrams and principles.

HPI

The Hogan Personality Inventory (HPI) (Appendix A) was administered to assess non-cognitive "motivational" aspects of individual differences. The HPI contains six trait dimensions described as follows:

1. Sociability (SO) - persons at the high end of this continuum are affiliative, outgoing, and enjoy helping others. Persons at the low end prefer to work alone and specialize in technology as opposed to social relations.
2. Prudence (PR) - persons high on prudence are conscientious, planful, and conforming. Those low on this dimension are impulsive, disorderly, spontaneous, and imaginative.
3. Intellectence (INT) - persons high on this dimension are seen as sharp, quick witted, and having good judgement. The low end describes those seen as slow, confused, and having poor judgement.

4. Adjustment (AD) - those high on adjustment are self confident, good spirited, and have a predictable disposition. Persons on the low end are moody, anxious, depressed, self-defeating, and unpopular.
5. Ambition (AM) - persons high on ambition are energetic, leaderlike, and show initiative in social situations. Those on the low end are perceived as passive, dependent, and submissive.
6. Likability (LI) - persons high on this continuum are seen as being cooperative, dependable, and warm. Those on the low end are perceived as being uncooperative, complaining, and difficult to deal with.

Each of the above dimensions contain several distinguishing characteristic facets for which miniature scales, called Homogeneous Item Composites (HIC), were formed. Reliability information for each scale and its constituent HICs are given in Appendix B.

Procedure

The Naval Basic Electricity and Electronics school served as the setting for this study. This school is a prerequisite for a variety of technical "A" schools. The BE&E school provides self-paced, individualized instruction via computer administration. Even though students are screened and placed on the basis of ASVAB score requirements, a large number still fail to complete training in the allotted time or even at all. The average drop rate (non-voluntary) ranges from 20 to 35% and, in some cases, may be higher (Nauta, Ward,

and D'Ambrosia, 1983). These drops are categorized as academic or motivational drops. The concern of school administrators is how to predict those labeled motivational drops. While they have faith in the ASVAB for predicting general ability and academic drops, they recognize the need for motivational indicators which the ASVAB fails to provide.

Administration of the HPI took place during the indoctrination course prior to entry in the BE&E school. Research subjects were informed as to the nature of the study and confidentiality of results via an information and consent form (Appendix C).

The ASVAB was administered to all recruits prior to selection and placement in training programs. ASVAB test scores were obtained from the BE&E school's student history reports.

Students were tracked through completion of the first 25 BE&E instructional modules. Modules 1-14 cover AC/DC electrical circuits and components while modules 15-25 introduce test equipment and solid state circuits. The average time required for the completion of the 25 modules was 9 to 12 weeks.

Criterion Measures

Performance in training was assessed by measures on seven variables. These variables and the corresponding coding of each are described in detail as follows:

1. Final Academic Standing (FAS)

Final academic standing categories include graduate, academic drop, or motivational drop. An academic drop indicates that the student does not have the ability

necessary to complete training. A motivational drop indicates that the student has the ability but lacks the drive, desire, or initiative to complete training. A motivational drop is considered dishonorable whereas an academic drop is acceptable and graduate Status is, of course, preferable. To reflect this difference in status, motivational drops were coded 0, academic drops 1, and graduates 2.

2. Final School Grade (FSG)

Students receive a percentile score based on major test grades, performance tests, and all remedial grades. These scores were recorded for this variable.

3. Number of Remedials (REM)

For each of the instructional modules, students must pass a competency test before proceeding to the next module. When a student fails a test, that student receives remediation and is then retested. This routine is repeated until the test is mastered. This variable measures the number of times a student is retested on the same material.

4. Time to Completion (TC)

Due to the self paced nature of the training, the amount of time spent in training varies for each individual. This measure reflects the average amount of time, in hours and tenths of hours needed to complete one module of training.

5. Academic Day Off (ADO)

Students are given permission to miss a normal school day when the student is perceived to be exhibiting outstanding effort in training (regardless of performance). Scores on this variable indicate the number of times a student receives a day off.

6. Suspensions (SC)

Students who demonstrate consistent academic problems are suspended, usually to be reviewed by a panel to determine whether an alternative training placement is necessary. This variable recorded the number of times a student was suspended.

7. Number of Modules Completed (MODS)

This variable recorded the number of training modules the student completed before training was terminated.

DATA ANALYSIS

All analyses were conducted using the IBM P.C. version of the Statistical Package for the Social Sciences (SPSSPC+) with advanced Statistics.

The seven individual criterion variables were factor analyzed using a principle components procedure with Varimax rotation. Component scores were then obtained for each subject to be used in further analysis.

Several multiple regression analyses were conducted using the component scores and selected individual variables as criterion to be predicted by the ASVAB and the HPI.

RESULTS

Factor Analysis of Criterion Variables

Intercorrelations among the seven criterion variables are illustrated in Appendix D. The principle components method revealed two underlying dimensions or factors with Eigenvalues greater than one. Together, the two factors account for 71% of the variance on the criterion variables, with factor 1 accounting for the greatest percentage (54%). Table 1 (Appendix E) contains the varimax rotated factor matrix.

The highest loadings occurred on factor 1. This factor, labeled Objective Performance (OP), is identified by a combination of the "traditional" academic performance variables. Specifically, the dependent measures defining factor 1 include: final academic standing, time to completion, number of training modules completed, number of remedials, and suspensions. Factor 2 is primarily identified by the variable academic day off. Academic days off are given relative to the instructors perception that the student is displaying exceptional effort, regardless of academic performance. Thus, Factor 2 was labeled Subjective Performance (SP).

Regression Analysis

The second set of results addresses the primary research question of this study: Can the HPI add significantly to training performance prediction above that obtained with the ASVAB?

Multiple regressions with simultaneous independent variable entry were conducted for both subgroup models (ASVAB, HPI) and the full prediction model (ASVAB + HPI) with the derived factor criteria 1 and 2 (tables 2 and 3, respectively, Appendix E). Independent variable intercorrelations and correlations with the dependent measures are illustrated in Appendix D.

The validity of the full prediction model with the objective performance criterion was substantial ($R = .56$, $p < .01$). Together, the HPI and ASVAB account for 32% ($R^2 = .32$) of the variance in objective training performance. The regression equation was as follows:

$$Y' = 6.25 - .05 (LI) - .12 (AM) + .08 (PR) + .14 (AD) + .01 (50) - .12 (INT) - .15 (EI) - .33 (MK) - .08 (65) - .06 (MC).$$

The shrinkage estimate was applied to test the stability of the relationship. The R^2 estimate (.27) predicts a loss of 5% of variance determined by these measures when applied to another sample.

The HPI composite alone significantly predicted objective performance ($R^2 = .17$). However, when added to the ASVAB composite, the resulting increase in R^2 (.04) failed to reach significance, $F(6, 144) = 2.17$, $p > .05$. Neither the subgroup, nor the full model regression with factor 2 (subjective performance) attained significance. Thus, the major hypothesis was not supported.

Multiple Regression with Selected Dependent Variables

It was concluded that, for practical application, school administrators might wish to predict specific student behavior rather than an empirically derived overall "performance" measure. Also, while

the full HPI composite failed to aid in this "performance" prediction, certain HPI scales or combination of scales could, conceivably, aid in the prediction of selected single dependent measures. The third set of results addresses these issues by attempting to identify the best set of variables for predicting specific training performance criteria. Given that the ASVAB will most likely always exist as the primary prediction device, the strategy was to first identify the significant ASVAB scale predictors and then to see which HPI scales, if any, would enter the equation to enhance that prediction.

A blockwise selection of predictors was employed. The first step entailed the computation of stepwise regressions with the ASVAB and each single dependent variable. The ASVAB scales Mathematics Knowledge (MK) and Electronics Information (EI) emerged as the primary predictors for most criteria (Final Academic Standing, Final School Grade, Time to Completion, Remediation, Suspensions) while the scales General Science (GS) and Arithmetic Reasoning (AR) reached significance for only one criterion each, Number of Modules Completed and Time to Completion, respectively (see Table 4, Appendix E). No ASVAB scales predicted the Criterion Academic Day Off.

In the second step of the blockwise procedure, the significant ASVAB Scales were retained in the regression equation and HPI Scales were then allowed to enter using a stepwise method. For four of the seven criterion variables, several HPI scales met the .05 entrance requirement to produce the following "best" predictor composites.

Final school grades (FSG) are best determined by the ASVAB Scales Mathematics Knowledge (MK), and Electronics Information (EI) and the HPI

Scale Prudence (PR) ($Y' = 54.27 + .26 (EI) + .32 (MK) - .15 (PR)$).

Together, these variables account for 22% ($R^2 = .22$) of the variance in final school grades.

The criterion variable Time to Completion (TC) was best predicted by the ASVAB scales Arithmetic Reasoning (AR), Mathematics Knowledge (MK), and Electronics Information (EI), and the HPI scale Intellectance (INT) ($Y' = 63.99 - .17 (AR) - .28 (MK) - .14 (EI) - .15 (INT)$).

Twenty-eight percent of the variance in training completion time was determined by these variables.

The greatest contribution by HPI Scales was in the prediction of the Remediation (REM) criterion. The HPI Scales Intellectance (INT), Adjustment (AD), and Prudence (PR), together with ASVAB Scales Electronics Information (EI), and Mathematics Knowledge (MK) accounted for 34% ($R^2 = .34$) of the variance on the remediation criterion ($Y' = 15.24 - .17 (EI) - .36 (MK) - .24 (INT) - .15 (AD) + .14 (PR)$). The estimated shrinkage in R^2 (from .34 to .32) indicates a stable relationship for these variables.

Finally, the criterion measure Number of Modules Completed (MODS) is best determined by the ASVAB Scales General Science (GS) and Mathematics Knowledge (MK) and the HPI Scale Ambition ($Y' = -15.78 + .20 (GS) + .27 (MK) + .12 (AM)$). Nineteen percent of the variance in the number of modules completed was accounted for by these variables.

Table 5 contains summary statistics for these regressions.

DISCUSSION

The major analysis failed to support the general hypothesis of this study. That is, the full HPI composite failed to significantly increase the prediction of the overall training performance measure above that obtained with the ASVAB. Contrary to results in similar studies (Yarkin-Levine et al., 1983; Hogan and Hogan, 1985), the ASVAB was quite successful in predicting performance in BE&E technical training. That is not to say that the HPI was unsuccessful in predicting performance. Rather, the inability to provide significant supplemental information was due to a surprising finding of shared variance between the two composites, especially between the HPI Scale Intellectance and the ASVAB Scale Mathematics Knowledge.

As might be expected, the cognitive measure (ASVAB) failed to predict the subjective performance measure, Academic Day Off. This measure was intended to reflect non-academic performance (effort) as perceived by the instructors, and was thought to be predictable via personality measures. However, this was not the case; the HPI also failed to predict subjective performance. The inability of both the ASVAB and HPI in predicting this criterion is thought to be attributable to problems inherent in the nature of the criterion itself. It is suspected that inconsistencies in different instructors interpretations and allocations of the performance reward resulted in a convoluted and unreliable view of this aspect of trainee performance.

While the HPI failed to add to the prediction of overall "performance," certain scales were found to be significant in the follow-up analyses which sought to identify the best predictor composite for specific training criteria. It is important to note, however, that the ASVAB continued to be the primary source of predictive information. These results suggest that, in addition to high aptitude in mathematics and electronics, persons who attain high course grades are imaginative and non-conforming and persons requiring little remediation are self confident, assertive, imaginative, and non-conforming. Those most quickly trainable are assertive, imaginative, interested in education and have high aptitude in mathematic, arithmetic reasoning, and electronics. Those most likely to complete training are competitive, assertive, achievement oriented and have high aptitude in mathematics and general science.

These mini profiles provide insight into the critical questions of who will perform best in training, complete training most quickly, or be able to succeed in training (Gordon and Cohen, 1973; Gordon and Kleiman, 1976). Questions such as these have important implication for effective training in terms of both human and financial resources. While training research has progressed by leap and bounds in the areas of training techniques, instructional content, and program evaluation/ cost analysis, knowledge of the individual determinant has lagged behind.

CONCLUSIONS

Proper selection for training is an important determinant of the probable success of any training program. Early identification of individuals who will benefit most from specific types of training, perform at a higher level in training or who may profit from accelerated or supplemental training has important implications in terms of training efficiency and cost effectiveness.

Recent results suggest that ability measures, in particular the ASVAB, fail to successfully identify these behavioral tendencies. Yet, in this study, the ASVAB's predictive validity was found to be moderate to substantial. The HPI composite predicted objective, academic performance as well, yet failed to add significant predictive power when added to the ASVAB. Furthermore, certain HPI Scales, when combined with certain ASVAB Scales were found to be significant in predicting a number of training criteria. Given these somewhat confusing results, exactly what can be concluded as the major findings of this study?

First, it can be concluded that the ASVAB does a fairly good job of predicting objective performance in the Naval BE&E training school. Secondly, the HPI was moderately successful in achieving this same goal. Thus, personality measures are able to predict training performance. Due to an apparent overlap in shared variance between these two measures, the increase in prediction when added together is not significant. Quite possibly, the premise that cognitive and

non-cognitive attributes are separate, unrelated entities may not be as absolute as previously thought.

Some HPI Scales did enter equations with selected ASVAB Scales to produce the "best" predictor composites for certain performance criteria. However, the ASVAB Scales were still the primary determinant of variance for these criteria. It is concluded that for the criteria Final School Grade, Time to Completion and Number of Modules Completed, prediction accuracy using these "best" composites would probably not differ from that obtained using the normal ASVAB composite. Prediction of the criterion Number of Remedials does appear to be substantially enhanced using this "best" composite. However, it would not be feasible to institute change simply for this performance measure. The amount of remediation required for a particular student is not of extreme importance as it does not appear to affect either the amount of time spent in training or whether or not a student will complete training. Possibly, in training situations where remediation is of more practical importance, it may be beneficial to examine personality influences.

These results, far from being substantially conclusive, at least verify the complexity and influence of individual differences in training situations. It is quite possible that for traditional academic training, cognitive predictors will provide the most valuable information in terms of individual potential. Personality may have a more profound effect in cases of unconventional skill training or training for occupations of risk (see Hogan and Hogan, 1985). Future research needs to consider the differences in job types for which training is intended.

APPENDIX A

HOGAN PERSONALITY INVENTORY

HPI

Following is a series of statements. Please read each one, decide how you feel about it, and then mark an "X" in either the box marked TRUE (meaning you agree with the statement) or FALSE (meaning you disagree with the statement).

TRUE FALSE

- | | | |
|---------------|---------------|--|
| <u> </u> | <u> </u> | 1. It is easy for me to talk to strangers. |
| <u> </u> | <u> </u> | 2. I never resent not getting my way. |
| <u> </u> | <u> </u> | 3. I think crowded public events (rock concerts, sports events) are very exciting. |
| <u> </u> | <u> </u> | 4. It is always best to tell the truth. |
| <u> </u> | <u> </u> | 5. I enjoy telling jokes and stories. |
| <u> </u> | <u> </u> | 6. I'm good at cheering people up. |
| <u> </u> | <u> </u> | 7. Before meeting someone, I often think of what I will say. |
| <u> </u> | <u> </u> | 8. In school I worked hard for my grades. |
| <u> </u> | <u> </u> | 9. As a child I was always reading. |
| <u> </u> | <u> </u> | 10. Sometimes I feel like a failure. |
| <u> </u> | <u> </u> | 11. Happiness is more important than fame. |
| <u> </u> | <u> </u> | 12. I am a relaxed, easy-going person. |
| <u> </u> | <u> </u> | 13. I am confused about what I want to be. |
| <u> </u> | <u> </u> | 14. I shouldn't do many of the things I do. |
| <u> </u> | <u> </u> | 15. It upsets me to hurt people's feelings. |
| <u> </u> | <u> </u> | 16. I am sensitive to other people's moods. |
| <u> </u> | <u> </u> | 17. I sometimes take a new way home just because it is different. |
| <u> </u> | <u> </u> | 18. When I'm in a group I usually do what the others want. |
| <u> </u> | <u> </u> | 19. I sometimes feel like I am watching myself. |
| <u> </u> | <u> </u> | 20. Most people think I am smart. |
| <u> </u> | <u> </u> | 21. I enjoy making people feel better. |

- ___ 22. I would like to be a computer programmer.
- ___ 23. When I'm in a bad mood, no one can please me.
- ___ 24. I remember phone numbers easily.
- ___ 25. I would enjoy writing music for a living.
- ___ 26. Sometimes I feel like I'm falling apart.
- ___ 27. I like classical music.
- ___ 28. I sometimes show off if I get a chance.
- ___ 29. I would like to work with high explosives.
- ___ 30. I strive for perfection in everything I do.
- ___ 31. I often wonder what people are thinking of me.
- ___ 32. There are a lot of things about myself that I would to change.
- ___ 33. I tend to be critical of others.
- ___ 34. I hold grudges for a long time.
- ___ 35. I am cranky and irritable when I don't feel well.
- ___ 36. I enjoy working with people.
- ___ 37. I have never hated anyone.
- ___ 38. I always try to see the other person's point of view.
- ___ 39. I want more of everything.
- ___ 40. I am a leader in my group.
- ___ 41. I expect to succeed in things I do.
- ___ 42. I often lose my temper.
- ___ 43. I would like to learn to scuba dive.
- ___ 44. I get excited very easily.
- ___ 45. I have often acted against my parents' wishes.
- ___ 46. I wish my life were more predictable.

- ___ 47. I feel guilty about some of the things I have done.
- ___ 48. I am always arguing with people.
- ___ 49. I have a natural talent for influencing people.
- ___ 50. I like challenges.
- ___ 51. I am a very self-confident person.
- ___ 52. When I was in school I gave the teachers a lot of trouble.
- ___ 53. It is as important to seem honest as it is to be honest.
- ___ 54. I want to be an important person in my community.
- ___ 55. I wish I knew what I wanted out of life.
- ___ 56. In school I didn't like math.
- ___ 57. I don't care if others like the things I do.
- ___ 58. I wouldn't mind driving a truck across the country for a living.
- ___ 59. I seldom pay attention to how I look.
- ___ 60. It bothers me when my daily routine is interrupted.
- ___ 61. At work I never waste time socializing.
- ___ 62. It makes me nervous to talk to members of the opposite sex.
- ___ 63. I'm always tired.
- ___ 64. I get nervous if I think someone is watching me.
- ___ 65. I would enjoy sky-diving.
- ___ 66. I would rather stay home and read than go to a party.
- ___ 67. I enjoy solving riddles.
- ___ 68. I would do almost anything on a dare.
- ___ 69. I don't mind criticizing people, especially when they need it.

- ___ 70. It is exciting to be part of a large crowd.
- ___ 71. I don't mind talking in front of a group of people.
- ___ 72. It makes me uncomfortable to enter a room full of people.
- ___ 73. I prefer that other people don't pay much attention to me.
- ___ 74. I sometimes wanted to run away from home.
- ___ 75. I think I would enjoy living alone.
- ___ 76. I would never bet on a horse race.
- ___ 77. When I deal with cashiers and sales clerks I am all business.
- ___ 78. I don't really care what other people think of me.
- ___ 79. In school it was hard for me to talk in front of the class.
- ___ 80. It's okay to brag a little about your accomplishments.
- ___ 81. I always practice what I preach.
- ___ 82. I daydream a lot.
- ___ 83. I do my job as well as I possibly can.
- ___ 84. I want to be the best at everything I do.
- ___ 85. I would like to know more history.
- ___ 86. I ought to treat people better than I do.
- ___ 87. I would like to be in a talent show.
- ___ 88. I don't have anyone I can really talk to.
- ___ 89. Most of the time I am proud of myself.
- ___ 90. I sometimes wish I were somebody else.
- ___ 91. I get away with a lot of things.
- ___ 92. I am often careless about my appearance.
- ___ 93. I'm known for coming up with good ideas.

- ___ 94. I often feel anxious.
- ___ 95. I make my bed every day.
- ___ 96. In school, I was sometimes sent to the principal for my behavior.
- ___ 97. I don't like things to be uncertain and unpredictable.
- ___ 98. I'm not afraid to be the first to try something.
- ___ 99. When people are nice to me I wonder what they want.
- ___ 100. I never know what I will do tomorrow.
- ___ 101. I enjoy reading poetry.
- ___ 102. I am good at telling jokes and funny stories.
- ___ 103. I am seldom tense or anxious.
- ___ 104. I find it hard to express my feelings.
- ___ 105. I have never taken advantage of anyone.
- ___ 106. The future seems hopeless to me.
- ___ 107. I want people to look up to me.
- ___ 108. Everyone has some good qualities about them.
- ___ 109. I frequently have indigestion.
- ___ 110. I plan my work very carefully in advance.
- ___ 111. Many people would say that I am shy.
- ___ 112. I don't let little things bother me.
- ___ 113. I would like to go mountain climbing.
- ___ 114. Putting on an act for people is often necessary.
- ___ 115. I can't do anything well.
- ___ 116. When someone gives me a job to do I finish it no matter what.
- ___ 117. I get out of breath more easily than I used to.
- ___ 118. I enjoy showing off a little now and then.

- ___ 119. I enjoy a strong desire for success in the world.
- ___ 120. I like to try new, exotic foods.
- ___ 121. Nothing good ever happens to me.
- ___ 122. I enjoy helping people.
- ___ 123. In a group, I never attract attention to myself.
- ___ 124. In school, I memorized facts quickly.
- ___ 125. I often think about the reasons for my actions.
- ___ 126. I won't start a project unless I know how it will turn out.
- ___ 127. I would like a job that requires traveling.
- ___ 128. I like large, noisy parties.
- ___ 129. I read at least ten books a year.
- ___ 130. I like to talk to people.
- ___ 131. As a child, school was easy for me.
- ___ 132. I enjoy working crossword puzzles.
- ___ 133. I sometimes have too much to drink.
- ___ 134. Sometimes I felt my parents didn't love me.
- ___ 135. I was a slow learner in school.
- ___ 136. I like to gamble.
- ___ 137. I'm uncertain about what I do with my life.
- ___ 138. I tend to give up when I meet difficult problems.
- ___ 139. In order to get along with people, I sometimes pretend to be interested in them.
- ___ 140. I get annoyed by others' bad manners.
- ___ 141. I like to do things on the spur of the moment.
- ___ 142. I consider carefully what clothes to wear each day.
- ___ 143. I have a good imagination.

- _____ 144. I sometimes do things just so other people will notice me.
- _____ 145. I frequently praise others.
- _____ 146. Before doing something, I usually consider what my friends will think.
- _____ 147. I have a large vocabulary.
- _____ 148. I set high standards for myself.
- _____ 149. People are always nice to me.
- _____ 150. I like parties and socials.
- _____ 151. I get bored easily.
- _____ 152. I don't enjoy a game unless I win.
- _____ 153. It is more important to get the job done than to worry about people's feelings.
- _____ 154. It is always best to stick with a plan that works.
- _____ 155. I like a lot of variety in my life.
- _____ 156. I don't think much about the future.
- _____ 157. I am almost always too hot or too cold.
- _____ 158. I find it hard to work under strict rules and regulations.
- _____ 159. I have been in trouble for drinking too much.
- _____ 160. I would rather read than watch T.V.
- _____ 161. In school I am/was usually in the upper part of my class.
- _____ 162. Sometimes I am hard to get along with.
- _____ 163. I never go out of my way to help others.
- _____ 164. I am a quick-witted person.
- _____ 165. I am a follower, not a leader.
- _____ 166. I worry a lot.

- _____ 167. I often wonder about how I got to be the way I am.
- _____ 168. There were times when I resented my parents.
- _____ 169. I've considered suicide.
- _____ 170. I get depressed a lot.
- _____ 171. I am often the life of the party.
- _____ 172. I am a good listener no matter whom I talk to.
- _____ 173. People can depend on me.
- _____ 174. I generally trust people until they prove me wrong.
- _____ 175. As a youngster in school I was suspended for my behavior.
- _____ 176. I like to be the center of attention.
- _____ 177. The best part of my day is the time I spend alone.
- _____ 178. I have taken things apart just to see how they work.
- _____ 179. I know when I am being myself.
- _____ 180. I can do long division in my head.
- _____ 181. Other people's opinions of me are not important.
- _____ 182. Planning things in advance takes the fun out of life.
- _____ 183. I would like to be a racecar driver.
- _____ 184. I frequently have headaches.
- _____ 185. I like to hear lecturers on world affairs.
- _____ 186. It often seems that my life has no meaning.
- _____ 187. I frequently feel guilty.
- _____ 188. I get tired of doing things the same old way.
- _____ 189. If something is worth doing, it is worth doing well.
- _____ 190. I think I would like to do research.
- _____ 191. People usually follow my suggestions.

- ___ 192. I expect too much of myself.
- ___ 193. I have never been in trouble with the law.
- ___ 194. It is hard to act naturally when I am with new people.
- ___ 195. People can usually tell what I'm feeling.
- ___ 196. I am not very inventive.
- ___ 197. I am usually aware of my inner feelings.
- ___ 198. I'm a humble person.
- ___ 199. I have a hard time making choices and decisions.
- ___ 200. When I am in a bad mood, I let other people know it.
- ___ 201. If it were legal, I might experiment with heroin.
- ___ 202. In school, math was easy for me.
- ___ 203. I would rather take orders than give them.
- ___ 204. I would like to be a deep-sea diver.
- ___ 205. I find Greek mythology interesting.
- ___ 206. I can get along with just about anybody.
- ___ 207. I am too busy to worry about my appearance.
- ___ 208. I have been in trouble for experimenting with marijuana or other drugs.
- ___ 209. I like what I do for a living.
- ___ 210. I have little self-confidence.
- ___ 211. I would volunteer for an Army drug experiment.
- ___ 212. I feel like life is just passing me by.
- ___ 213. I like doing two things at once.
- ___ 214. I would enjoy working by myself in a scientific laboratory.
- ___ 215. I have a lot of friends.
- ___ 216. I keep calm in a crisis.

- _____ 217. I am a forgiving person.
- _____ 218. I am often irritated by faults in others.
- _____ 219. I'm cautious by nature.
- _____ 220. I am an ambitious person.
- _____ 221. I sometimes do things that are illegal.
- _____ 222. I don't trust people unless I know them very well.
- _____ 223. I love the hustle and bustle of city crowds.
- _____ 224. I have let a lot of people down.
- _____ 225. I am a fast reader.
- _____ 226. I am a good speller.
- _____ 227. I never deliberately defied my parents.
- _____ 228. I hate opera singing.
- _____ 229. I can make up stories quickly.
- _____ 230. When I'm mad, I seldom show it.
- _____ 231. I am a hard and steady worker.
- _____ 232. I like to play chess.
- _____ 233. I frequently do things on impulse.
- _____ 234. I am interested in science.
- _____ 235. I can multiply large numbers quickly.
- _____ 236. I don't show my emotions to others.
- _____ 237. I like not knowing what tomorrow will bring.
- _____ 238. I am good at inventing games, stories or rhymes.
- _____ 239. I often feel that I chose the wrong occupation.
- _____ 240. I rarely get angry with others.
- _____ 241. I usually feel good.
- _____ 242. Most people are nice once you get to know them.

- _____ 243. I believe people are basically honest.
- _____ 244. I used to steal sometimes when I was a kid.
- _____ 245. I like to work on several projects at the same time.
- _____ 246. I like detective stories.
- _____ 247. I work well with other people.
- _____ 248. I always try to do a little more than what is expected of me.
- _____ 249. I am careful about my appearance.
- _____ 250. I have never deliberately told a lie.
- _____ 251. I never resent being asked for a favor.
- _____ 252. I enjoy just being with other people.
- _____ 253. Nothing seems to matter to me anymore.
- _____ 254. I always work hard, even when I'm not feeling well.
- _____ 255. I rarely get anxious about my problems.
- _____ 256. I often try to understand myself.
- _____ 257. There are a lot of things I would like to change about my past.
- _____ 258. I am a happy person.
- _____ 259. I like to give orders and get things moving.
- _____ 260. I can use a microscope.
- _____ 261. I understand why stars twinkle.
- _____ 262. I sometimes pretend to know more than I do.
- _____ 263. I often analyze my motives.
- _____ 264. Life is no fun when you play it safe.
- _____ 265. People seem to underestimate my intelligence.
- _____ 266. I am usually calm.
- _____ 267. I am a sociable person.

- _____ 268. I often start things I never finish.
- _____ 269. I like doing things that no one else has done.
- _____ 270. I sometimes feel irritated without any good reason.
- _____ 271. I don't hate anyone.
- _____ 272. Before going out, I think carefully about what I will wear.
- _____ 273. I have a good memory.
- _____ 274. As a child I could always go to my parents with my problems.
- _____ 275. I enjoy meeting new people.
- _____ 276. I like to have a schedule and stick to it.
- _____ 277. I rarely make a promise that I don't keep.
- _____ 278. Basically, I am a cooperative person.
- _____ 279. I would like to be an inventor.
- _____ 280. When I was young, there were times when I felt like leaving home.
- _____ 281. I often say things without thinking.
- _____ 282. As a child, my home life was usually happy.
- _____ 283. I enjoy the excitement of the unknown.
- _____ 284. Sometimes I enjoy going against the rules.
- _____ 285. I would go to a party every night if I could.
- _____ 286. I am not a competitive person.
- _____ 287. I usually notice when I am boring people.
- _____ 288. My successes mean little to me.
- _____ 289. I enjoy giving parties.
- _____ 290. I always notice when people are upset.
- _____ 291. I don't care for large, noisy crowds.

- _____ 292. My sexual behavior has gotten me in trouble.
- _____ 293. I think I would enjoy having authority over people.
- _____ 294. In a group, I like to take charge of things.
- _____ 295. At parties, I am often the last to leave.
- _____ 296. I often say things I regret.
- _____ 297. I usually feel that life is worthwhile.
- _____ 298. My health is excellent.
- _____ 299. I am always respectful when talking to people in authority.
- _____ 300. I am easy to get along with.
- _____ 301. I am a patient person.
- _____ 302. I'm known as a wit.
- _____ 303. I don't like to try things when I think I might fail.
- _____ 304. I would never cry in public.
- _____ 305. I'm pretty careful in my work.
- _____ 306. People pretend to care more about one another than they really do.
- _____ 307. People think I am an introvert.
- _____ 308. I am always polite, even to loud-mouthed, obnoxious people.
- _____ 309. I would rather work with facts than people.
- _____ 310. I often do things I don't want to do.

APPENDIX B

HPI RELIABILITY INFORMATION

HPI Scales, Constituent HICs, and Respective Alpha Reliability Estimates

Scale	No. of Items	Alpha
Intellectance	41	.85
HICs		
1. Good memory	5	.61
2. School success	3	.70
3. Math ability	4	.77
4. Reading	4	.72
5. Cultural taste	4	.65
6. Curiosity	4	.60
7. Intellectual games	4	.64
8. Generates ideas	5	.67
9. Intelligence	4	.51
10. Divergent thinking		.53
Adjustment	68	.94
HICs		
11. Not anxious	4	.84
12. No somatic complaint	9	.69
13. Not depressed	10	.82
14. No guilt	5	.60
15. No social anxiety	8	.78
16. Self-confidence	5	.75
17. Self-esteem	7	.59
18. Identity	7	.80
19. Calmness	5	.64
20. Good attachment	8	.81
Ambition	3	.83
HICs		
21. Sets high standards	7	.69
22. Leadership	13	.82
23. Status seeking	7	.60
24. Tenacity	8	.51
25. Influence	4	.60
26. Entertaining	4	.67
Likability	65	.90
HICs		
27. Attentive	6	.57
28. Dependable	6	.62
29. Tolerant	10	.67
30. Flattering	4	.58
31. Caring about others	7	.72
32. Even tempered	9	.75
33. Cheerful	10	.68
34. Cooperative	7	.74
35. Trusting	6	.63

Scale	No. of Items	Alpha
Sociability	43	.87
HICs		
36. Sociable	23	.81
37. Enjoys crowds	5	.77
38. Exhibition	10	.78
39. Expressive	5	.62
Prudence		
HICs		
40. Caution	5	.56
41. Avoids trouble	12	.75
42. Predictability	5	.54
43. Planful	17	.73
44. Not experience seeking	9	.56
45. Not thrill seeking	7	.79

NOTE: From "A Socioanalytic Theory of Personality" by R. Hogan, 1983,
In M. Page (Ed.) Nebraska Symposium on Motivation, p 71.

APPENDIX C

PARTICIPANT CONSENT FORM

PARTICIPANT INFORMATION

The Human Factors Division, Naval Training Systems Center, is conducting a study in cooperation with the Service School Command and Chief of Technical Training. This study will examine the use of ASVAB and personal/social measures for determining training performance. Results from this investigation will help the Navy in the placement of future recruits to training schools.

As a participant in this study, you will be asked to complete a survey. This survey will ask you questions about your feelings, interests, and behaviors in everyday life. This task will take you approximately 20 to 25 minutes.

Your responses to the survey will be strictly confidential and your participation is voluntary. Names will be removed from the data sheets and replaced with numbers to protect your privacy. This data will be used to evaluate a procedure for future use in military training and does not affect your schedule.

Thank you for your cooperation.

NAME: _____

APPENDIX D
CORRELATION AND INTERCORRELATION
MATRICES FOR PREDICTORS AND CRITERIA

INTERCORRELATIONS BETWEEN CRITERION MEASURES

CRITERION	2	3	4	5	6	7
1. FAS	.34**	-.72**	-.69**	.12	-.58**	.94**
2. FSG	--	-.49**	-.56**	.23**	-.27**	.36**
3. TC		--	.84**	-.12	.36**	-.82**
4. REM			--	-.17*	.43**	-.80**
5. ADO				--	-.19**	.13*
6. SC					--	-.48**
7. Mods						--

* $p < .05$ ** $p < .01$

INTERCORRELATIONS BETWEEN HPI PREDICTORS

PREDICTOR	2	3	4	5	6
1. INT	.37**	.01	.37**	.02	.22**
2. AD	--	.11	.22**	.08	.27**
3. PR		--	-.07	-.20**	.13*
4. AM			--	.38**	.04
5. SO				--	.23**
6. LI					--

* $p < .05$ ** $p < .01$

INTERCORRELATIONS BETWEEN ASVAB PREDICTORS

PREDICTOR	2	3	4
1. MK	.10	.28**	.36**
2. EI	--	.54**	.40**
3. AR		--	.48**
4. GS			--

* $p < .05$ ** $p < .01$

CORRELEATION BETWEEN HPI AND ASVAB

HPI	ASVAB			
	MK	EI	AR	GS
INT	.42**	.23**	.26**	.41**
AD	.12	.18*	.18*	.09
PR	-.05	-.18*	-.21**	-.18*
AM	.17*	.11	.27**	.07
SO	.17*	-.02	.16*	.10
LI	.13	-.11	.04	.07

* $p < .05$ ** $p < .01$

CORRELATION BETWEEN PREDICTORS AND CRITERIA

PREDICTOR	CRITERION								
	FAS	FSG	TC	REM	ADO	SC	MODS	OP	SP
ASVAB									
MK	.29**	.35**	-.41**	-.47**	-.01	-.27**	.37**	-.45**	.06
EI	.19**	.32**	-.30**	-.27**	.03	-.20**	.22**	-.28**	.12
AR	.22**	.34**	-.37**	-.33**	.08	-.16*	.27**	-.32**	.15*
GS	.19**	.24**	-.37**	-.35**	-.00	-.17*	.31**	-.35**	.04
HPI									
INT	.24**	.23**	-.35**	-.38**	.09	-.21**	.29**	-.34**	.12
AD	.01	.04	-.10	-.00	.07	.03	.02	-.02	.06
PR	-.12	-.21**	.15*	.20**	-.13	.06	-.19**	.16*	-.16*
AM	.19**	.09	-.22**	-.18*	-.01	-.14*	.21**	-.23**	-.02
SO	.08	.07	-.13*	-.12	.00	.02	.13	-.12*	-.01
LI	-.02	.02	-.10	-.11	.08	-.03	.04	-.06	.07

* $p < .05$ ** $p < .01$

APPENDIX E
RESULTS TABLES

TABLE 1
VARIMAX ROTATED FACTOR MATRIX

CRITERION	FACTOR	
	1	2
FAS	-.91	.05
FSG	-.47	.52
TC	.89	-.12
REM	.87	-.22
ADO	.01	.92
SC	.57	-.25
MODS	-.95	.05

TABLE 2
SUBGROUP AND FULL MODEL REGRESSIONS WITH
FACTOR 1 (OBJECTIVE PERFORMANCE)

PREDICTION MODEL	R	R ²	ADJUST. R ²	SE	F
Subgroup					
ASVAB	.52	.27	.25	.86	14.11**
HPI	.41	.17	.13	.93	4.99**
Full Model					
ASVAB + HPI	.56	.32	.27	.86	6.62**

REGRESSION EQUATIONS

Subgroup

ASVAB $Y' = 6.89 - .12 (GS) - .37 (MK) - .15 (EI) - .09 (MC)$

HPI $Y' = .87 - .02 (LI) - .10 (AM) + .13 (PR)$
 $+ .12 (AD) - .05 (SO) - .35 (INT)$

Full Model

ASVAB + HPI $Y' = 6.25 - .05 (LI) - .12 (AM) + .08 (PR)$
 $+ .14 (AD) + .01 (SO) - .12 (INT) - .15 (EI)$
 $- .33 (MK) - .08 (GS) - .06 (MC)$

* $p < .05$ ** $p < .01$

TABLE 3
SUBGROUP AND FULL MODEL REGRESSIONS WITH
FACTOR 2 (SUBJECTIVE PERFORMANCE)

PREDICTION MODEL	R	R ²	ADJUST. R ²	SE	F
Subgroup					
ASVAB	.17	.03	.00	.99	1.06
HPI	.23	.05	.01	.99	1.33
Full Model					
ASVAB + HPI	.27	.07	.01	.99	1.14

REGRESSION EQUATIONS

Subgroup

ASVAB $Y' = -1.42 - .07 (GS) + .04 (MK) + .07 (EI) + .13 (MC)$

HPI $Y' = .21 + .07 (LI) - .07 (AM) - .18 (PR)$
 $+ .04 (AD) - .03 (SO) + .12 (INT)$

Full Model

ASVAB + HPI $Y' = .003 + .07 (LI) - .11 (AM) - .17 (PR)$
 $+ .01 (AD) - .02 (SO) + .15 (INT) + .05 (EI)$
 $+ .01 (MK) - .14 (GS) + .14 (MC)$

* $p < .05$ ** $p < .01$

TABLE 4
SIGNIFICANT ASVAB PREDICTORS WITH SELECTED CRITERION MEASURES

CRITERION	PREDICTOR(S)	REGRESSION STATISTICS			
		R	R ²	ADJUST. R ²	F
FAS	MK EI	.33	.11	.10	9.35**
FSG	MK EI	.45	.20	.19	19.20**
TC	MK AR EI	.51	.26	.24	17.51**
REM	MK EI	.52	.27	.26	28.26**
ADO	--	--	--	--	--
SC	MK EI	.32	.10	.09	8.44**
MODS	MK GS	.41	.17	.16	15.61**

* $p < .05$ ** $p < .01$

TABLE 5
SIGNIFICANT ASVAB AND HPI PREDICTORS WITH SELECTED CRITERION MEASURES

CRITERION	PREDICTORS		REGRESSION STATISTICS			
	ASVAB	HPI	R	R ²	ADJUST. R ²	F
FSG	MK EI	PR	.47	.22	.21	14.51**
TC	MK EI AR	INT	.53	.28	.26	14.41**
REM	MK EI	INT PR AD	.58	.34	.32	15.39**
MODS	MK GS	AM	.44	.19	.18	12.04**

*p < .05 **p < .01

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